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COMPUTER-AIDED COLLECTION OF DEMOGRAPHIC DATA WITHIN DAY-NIGHT --ETC(U)

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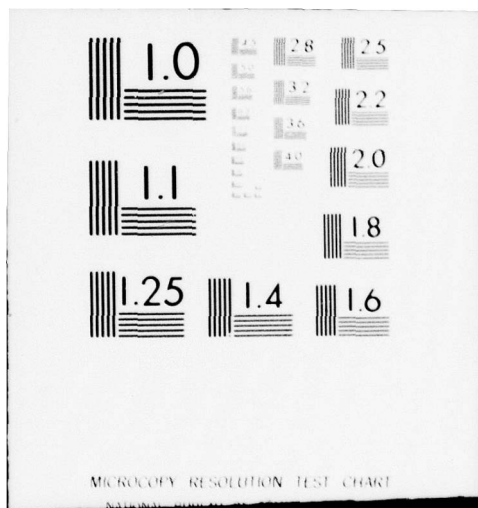
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**COMPUTER-AIDED COLLECTION OF DEMOGRAPHIC
DATA WITHIN DAY-NIGHT LEVEL CONTOURS:
TWO TEST CASES**

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AUGUST 1978

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AMRL-TR-78-39

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FOR THE COMMANDER


HENNING L. VON GIERKE
Director

Biodynamics and Bioengineering Division
Aerospace Medical Research Laboratory

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noise contours that are compatible with commercially available demographic programs using census tract data; and (3) outputting for land use planning purposes, demographic and socio-economic data for present or future years as a function of predicted noise exposure level. Salt Lake City Airport and Selfridge Air Force Base were run as test cases involving proposed changes in military aircraft operations in areas representing rural and urban environments. Results for Salt Lake City Airport showed that replacing 7.6 operations per day of KC-97 aircraft with 6.4 operations per day of KC-135A aircraft increased the land area within the Day-Night Level 65 contour from 13.4 square miles to 18.2 square miles and increased the number of people exposed from 190 people to 5789 people. Results for Selfridge Air Force Base showed that replacing 48 operations of F-100 aircraft with 30 operations of F-4 aircraft plus 48 operations of A-7 aircraft increased the DNL 65 contour area from 5.9 square miles to 11.5 square miles and increased the number of exposed people from 6334 people to 12097 people.

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SUMMARY

This study demonstrates the feasibility of automating a procedure for counting the number of people exposed to various levels of aircraft noise near airbases. The procedure involves: (1) developing contours of equal noise exposure about military installations based on aircraft noise and performance data and airport operational/flight track information using the NOISEMAP computer program; (2) developing polygon descriptions of the noise contours that are compatible with commercially available demographic programs using census tract data; and (3) outputting for land use planning purposes, demographic and socio-economic data for present or future years as a function of predicted noise exposure level. Salt Lake City Airport and Selfridge Air Force Base were run as test cases involving proposed changes in military aircraft operations in areas representing rural and urban environments. Results for Salt Lake City Airport showed that replacing 7.6 operations per day of KC-97 aircraft with 6.4 operations per day of KC-135A aircraft increased the land area within the Day-Night Level 65 contour from 13.4 square miles to 18.2 square miles and increased the number of people exposed from 190 people to 5789 people. Results for Selfridge Air Force Base showed that replacing 48 operations of F-100 aircraft with 30 operations of F-4 aircraft plus 48 operations of A-7 aircraft increased the DNL 65 contour area from 5.9 square miles to 11.5 square miles and increased the number of exposed people from 6334 people to 12097 people.

PREFACE

This research was performed for the Aerospace Medical Research Laboratory at Wright-Patterson Air Force Base, Ohio under Project/Task 723104, Measurement and Prediction of Noise Environments of Air Force Operations. Technical monitor for this effort was Mr. Jerry D. Speakman of the Biodynamic Environment Branch, Biodynamics and Bioengineering Division.

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INTRODUCTION

Determining the number of people exposed to various levels of aircraft noise has always been an extremely time consuming and expensive process. Census data are typically the basis for the determinations. A previous study explored the feasibility of incorporating demographic data in noise analysis. In this report, a method of automating the counting procedure and the gathering of other demographic data is investigated. It uses noise contours and 1970 census data that has been updated to 1976 population by professional demographers.

The noise contours were developed by the Air Force with the NOISEMAP¹ computer program. This program calculates the day-night average noise levels based upon aircraft noise and performance data, and airport operational and flight path information.

The following section describes the SITE II² computer program developed by CACI, Inc. that was used to determine the demographics. The procedure for developing polygons compatible with SITE II are then described. The final section displays the demographic data for areas inside noise contours around Salt Lake City Airport and Selfridge Air Force Base.

SITE II DEMOGRAPHIC PROGRAM

With the SITE II demographic computer program, the user specifies the geographic area of interest. The program searches into its data base, and then produces a variety of data reports.

The program has several very useful features. It allows extreme flexibility in the way the user specifies the area of interest. Most computer programs that retrieve census data require the user to specify the census tracts, county, Standard Metropolitan Statistical Area (SMSA) or state by a code number. Therefore, to determine the population inside an irregularly shaped polygon, the user must establish which tracts are to be covered.

With the SITE II program, it is necessary only to define a polygon*, and the program determines the census tracts to be

*A polygon is defined here as a closed geometric shape bounded by a finite number of straight line segments joined at their end points.

included.

Defining these cases also requires a site location and then some means of indicating the location of the line segment end points relative to the site location. This is done by determining how far north or south an endpoint is from the site in miles and how far east or west. Each endpoint must be from 0 - 99.9 miles away from the site location. All endpoints are defined in a clockwise sequence and after all have been located, the SITE II program will automatically connect them, forming a bounded area. Up to 150 such points may be defined in a given run.

Since all the demographic and housing data contained in the SITE Data Base have been collected for very small geographic units (census tracts or minor civil divisions), the SITE II program must select and aggregate several of these unit areas to form the user's defined area. Census tracts are small, relatively permanent areas into which large cities and adjacent areas are divided for the purpose of providing comparable small area statistics. The average tract has 4000 residents. Minor civil divisions are the primary political unit within a county (i.e., town, townships, and precincts) and are used for reporting data except where the county is also divided into census tracts.

The aggregation is done through the use of the "centroid rule." Each of these unit areas (census tracts, minor civil divisions, or components thereof) has a single location associated with it in space called its population centroid. This point is not the geographic center, but a weighted measure based on the distribution of population within a unit area. The centroid rule states that if this population centroid lies within the user's defined area, then the entire unit area is to be included. If the centroid lies outside, the unit area is excluded.

In most cases, it is possible to obtain reasonably close approximations to the user's defined area by utilizing the population centroids of census tracts or minor civil divisions. However, when more precise area definition is required, the user may request that the system include portions of census tracts or minor civil divisions. In this case, the SITE II program will determine what proportion of a tract or minor civil division will be included based on the tract or minor civil division component parts falling within the defined area. These components (block groups or enumeration districts) also have population centroids which the program evaluates to determine whether they are inside or outside of the user's defined area boundary.

Block groups and enumeration districts (BG/ED's) are small administrative units defined by the Census Bureau strictly for data collection purposes. All census tracts and minor civil divisions (MCD's) are composed of block groups or enumeration districts.

Block groups are combinations of small contiguous units having an average combined population of 1,000 persons. Block groups are defined for the areas which are tabulated via a census-by-mail program.

Enumeration districts are small areas encompassing approximately 250 housing units. They are used for the collection and tabulation of population and housing data for those areas which were not covered by the mail-out/mail-back census program, but were enumerated by individuals.

The program is capable of producing reports in a variety of forms. This includes a comprehensive list of all demographic data, a summary of the important attributes, or estimates of the population in future years for comparative purposes. For purposes of land planning, the total population figure is, of course, one of the prime outputs. In addition, there are other useful outputs to be had. In particular, the age distribution and property values may be of interest as well as the distribution of apartments versus single family dwellings. Also, the current market price distribution for residential properties can be very significant in some noise control plans.

The SITE II program is available on various timeshare systems or can be purchased for batch operation. For this study, SITE II was accessed through General Electric Timeshare. The cost of analysis was approximately \$50 per contour.

The major disadvantage of the timeshare system is that the polygon points must be entered by hand into the system. Since there can be up to 150 points, this process can be time consuming and subject to errors.

In a batch mode, it would be possible to access a file that contained the polygon points eliminating these problems.

The SITE II program can be purchased for installation on the user's computer. Annual updates to the census data are available for purchase.

POLYGON GENERATION

NOISEMAP does not produce the X-Y coordinates needed to define the polygon used by SITE II. Therefore, a procedure was developed that would automatically determine the polygon endpoints.

The NOISEMAP computer program calculates the day-night noise exposure levels (DNL) for a square grid of 100 by 100 points. The spacing between points is selectable; typically, a value of 1000 feet is used giving an area of approximately 350 square miles.

NOISEMAP is capable of generating a printer plot of the DNL values. This is a somewhat coarse representation of the contours. The method of calculation is to look at a limited number of points to determine if a contour value exists. The procedure steps through the grid points but does not follow the contour, i.e., contour points are not in order and cannot be easily connected with a line. To be compatible with SITE II, this procedure is not sufficient.

There are a variety of commercially available computer programs that calculate contour values so that they can be drawn with X-Y line plotters. The USAF CEC uses the GPCP (General Purpose Contouring Program) developed by California Computer Products, Inc. A similar program, SURFACE-MAP developed by Digital Enterprises, is available on the CDC Cykernet system. Both of these programs calculate the appropriate X,Y coordinates for a specified contour value. Since they are designed for line plotters, the values are ordered. Since the work in this study was performed on the CDC Cybernet system, SURFACE-MAP was used.

SURFACE-MAP has an advantage in that the user can specify a special computer file that will contain the X-Y data coordinates at the end of a run. GPCP outputs its data only in a format that is readable by the plotter. The program can be modified to give the coordinates in a useable format but the version of GPCP owned by the Air Force would have to be modified.

The contouring program normally subdivides the area between X-Y coordinate points and calculates interpolated values. This procedure smooths the contours. Since the SITE II program works on areas with a minimum size of city blocks or larger, this degree of smoothing is not necessary. Therefore, the subdivisions were eliminated to reduce costs. For very small contours, this

will cause some distortion. However, the areas surrounded by these small contours will be the airport property where few people live. This was not considered as a significant limitation.

The SITE II program needs polygon end points specified in terms of the number of miles north or south of a user specified base point. Therefore, a routine was written to convert the X-Y coordinates from SURFACE-MAP to coordinates useable by SITE II. This routine was called PRES2.

PRES2 reads the file of X-Y coordinates produced by SURFACE-MAP. Other parameters provided are the DNL value and a flag indicating whether the contour is open or closed. A closed contour is one that is completely defined with the given grid. An open contour is not completely defined, i.e., part of the contour falls outside the given grid area.

In addition to the X-Y coordinates, the user must specify the longitude and latitude of a base point. If the orientation of the contour set is other than true north being the vertical axis, then a rotation angle must be given.

For closed contours, the program checks to see if the number of X-Y coordinates is less than or equal to 150 points. If it is greater, the routine reduces the number to less than 150.

The program then determines if the contour given is in a clockwise or counter-clockwise order. If it is counter-clockwise, the program reverses the order of the points. The distance from the base point is then calculated. It is output in the form of displacement in the north/south direction and east/west direction, the format needed by SITE II.

For open contours, the procedure is more complicated because the contouring program does not calculate the segments of the contour in any order. For this analysis, the gaps between segments are filled by assuming the boundary of the area, i.e., grid areas are part of the contour. The assumed segments may or may not include corners. After the contours are artificially closed, the procedure is the same as for closed contours.

To fully assess an open contour, additional NOISEMAP and SURFACE-MAP runs would be necessary to cover the additional area. The contours of the various runs would then have to be put together. Alternatively, the NOISEMAP run could be re-run with a larger spacing between grid points so that the contours fit within a single area.

PRES2 is capable of handling any number of contours. The contours are processed sequentially and are assumed to have the same base point. The program has been successfully tested for a variety of closed and open contours. Artificial contours can be developed that the program cannot handle but these contours probably would never be encountered in practice.

A graphical representation of the contours could be developed so that the user could identify any problems before the demographics package was executed.

The basic technique for automating the process has been shown by the development of PRES2. Additional programming would be necessary to truly automate the process from NOISEMAP through SITE II. This would include modifying NOISEMAP to accept a base point with its longitude and latitude defined. Also, assuming SITE II is run in a batch mode, PRES2 would have to produce a file that contains all the necessary inputs to SITE II.

TEST CASES

Salt Lake City International Airport and Selfridge Air Force Base were selected for analysis. These represent rural and urban environments respectively. The NOISEMAP computer runs were available for both of the bases thus reducing computer costs. In addition at both bases, an alternate level of service and aircraft mix is being considered and the associated NOISEMAP runs has also been made. The change in number of people impacted could be determined for each level of service at each base.

The Air Force currently operates KC-97 aircraft at Salt Lake City International Airport. The contours associated with current operations are shown in Figure 1. It is proposed to replace 7.6 operations per day of KC-97's with 6.4 operations per day of KC-135's. The contours with KC-135 operations are shown in Figure 2. The coarseness of the contours results from modifications made to the plotting routine to reduce computer costs. As discussed earlier, the distortion is not significant for this type of analysis.

The demographic data was first retrieved for the Sale Lake City Airport with KC-135 aircraft because the contours were larger.



FIGURE 1. DNL NOISE CONTOURS SALT LAKE CITY INTERNATIONAL AIRPORT
EXISTING OPERATIONS

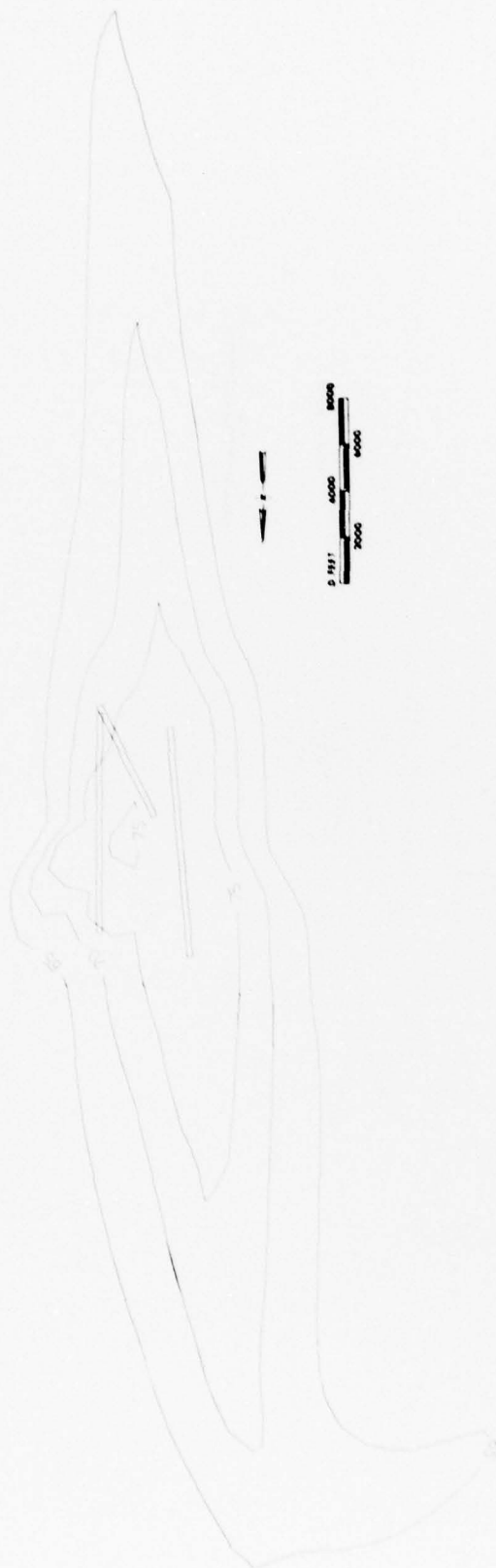


FIGURE 2. DNL NOISE CONTOURS SALT LAKE CITY INTERNATIONAL AIRPORT
WITH KC-135 AIRCRAFT

The results for the DNL 65 and 70 contours are shown in Tables 1 and 2, respectively. As can be seen, it is estimated that 5789 people live inside the 65 DNL contour but only 3 people live within the 70 DNL contour. There was no reason to calculate the number of people within the DNL 75 contour.

Table 3 shows the demographic data for the DNL 65 contour with existing operations. There are only 190 people within the contour. Since the DNL 70 contour for this case is smaller than the contour with KC-135 aircraft, the SITE II run was not made. It is known that the population would be less than or equal to 3 people.

Table 4 summarizes the change in population and area for the two cases at Salt Lake City International Airport. As can be seen, there is an increase of 5599 people exposed to DNL levels in excess of 65 if KC-135 aircraft are allowed. This increase is not obvious from the contours or from the acreage figures.

At Selfridge AFB, it is proposed to replace 48 operations of F-100 aircraft with 30 operations of F-4's plus 48 operations of A-7 aircraft. The contours for existing and modified conditions are shown in Figures 3 and 4. The demographic data for the DNL 65, 70 and 75 contours with the proposed replacement aircraft are shown in Tables 5 through 7, respectively. The same data for existing DNL 65 and 70 levels are shown in Tables 8 and 9. Since the population within the DNL 75 contour was only 9 for modified operations, the SITE II program was not run for the existing DNL 75 contour.

Table 10 tabulates the change in population at Selfridge AFB from existing conditions to modified operations. The increase in number of people exposed to levels greater than DNL 65 is 5763, and greater than DNL 70 is 4565. The acreage within the 65 and 70 DNL almost doubled with modified operations. The population doubled for the 65 DNL but there was about a 72 percent increase in people within the 70 DNL.

In both cases, the demographic data calculated provides additional information that is valuable in evaluating the noise impact around air bases.

RECOMMENDATIONS

This study demonstrates the feasibility of obtaining demographic data for areas within day-night level contours developed

DEGREES
LATITUDE 40.8500
LONGITUDE 111.9810

92 POINT POLYGON

WEIGHTING PCT 100%

```

*****
*                                     *
*                               LATEST  CHANGE                               *
*                                     FROM 70                               *
* 1976 POPULATION                5789                366                *
* 1976 HOUSEHOLDS                1702                284                *
* 1975 PER CAP INCOME  $ 2859                $ 649                *
*                                     *
* ANNUAL COMPOUND GROWTH                1.1%                *
*                                     *
*****

```

1970 CENSUS DATA

POPULATION			AGE AND SEX		MALE			FEMALE			TOTAL	
TOTAL	5423	100.0%										
WHITE	5384	99.3%	0-5	510	19.3%	527	19.0%					19.1%
NEGRO	0	0.0%	6-13	560	21.2%	533	19.2%					20.2%
OTHER	39	0.7%	14-17	199	7.5%	221	8.0%					7.7%
			18-20	98	3.7%	137	4.9%					4.3%
SPAN	203	3.7%	21-29	417	15.8%	498	17.9%					16.9%
			30-39	344	13.0%	335	12.1%					12.5%
			40-49	251	9.5%	247	8.9%					9.2%
FAMILY INCOME (000)			50-64	208	7.9%	193	6.9%					7.4%
\$0-5	175	13.6%	65 +	60	2.3%	87	3.1%					2.7%
\$5-7	198	15.4%	TOTAL	2647		2778						
\$7-10	355	27.6%	MEDIAN(AGE)	19.7		20.4						20.1
\$10-15	416	32.3%										
\$15-25	121	9.4%	HOME VALUE (000)			OCCUPATION						
\$25-50	18	1.4%	\$0-10	19	2.4%	MGR/PROF	344					19.2%
\$50 +	3	0.2%	\$10-15	201	25.5%	SALES	172					9.6%
TOTAL	1286		\$15-20	344	43.7%	CLERICAL	343					19.1%
			\$20-25	138	17.5%	CRAFT	292					16.3%
AVERAGE \$	9699		\$25-35	75	9.5%	OPERATIVES	364					20.3%
MEDIAN \$	9282		\$35-50	9	1.1%	LABORER	68					3.8%
			\$50 +	1	0.1%	FARM	5					0.3%
			TOTAL	787		SERVICE	204					11.4%
RENT						PRIVATE	3					0.2%
\$0-100	270	51.0%	AVERAGE	\$18491								
\$100-150	235	44.4%	MEDIAN	\$17515								
\$150-200	24	4.5%	% OWNER	59.8		EDUCATION		ADULTS	>	25		
\$200-250	0	0.0%				0-8		226		10.4%		
\$250 +	0	0.0%				9-11		550		25.3%		
TOTAL	529		AUTOMOBILES			12		888		40.8%		
			NONE	55	3.9%	13-15		304		14.0%		
AVERAGE \$	99		ONE	675	48.0%	16 +		208		9.6%		
MEDIAN \$	98		TWO	564	40.1%							
% RENTER	40.2		THREE+	112	8.0%							
						HOUSEHOLD PARAMETERS						
UNITS IN STRUCTURE			HOUSEHOLDS WITH:			FAM POP	5275			97.3%		
1	986	69.8%	TV	1321	93.2%	INDIVIDS	148			2.7%		
2	83	5.9%	WASHER	1146	80.8%	GRP QTRS	0			0.0%		
3-4	90	6.4%	DRYER	829	58.5%	TOT POP	5423					
5-9	106	7.5%	DISHWASH	171	12.1%	NO OF HH'S				1418		
10-49	98	6.9%	AIRCOND	225	15.9%	NO OF FAM'S				1295		
50 +	7	0.5%	FREEZER	497	35.0%	AVG HH SIZE				3.8		
MOBILE	42	3.0%	2 HOMES	42	3.0%	AVG FAM SIZE				4.1		

TABLE 1. DEMOGRAPHIC DATA FOR SALT LAKE CITY INTERNATIONAL AIRPORT
65 DNL CONTOUR WITH KC-135 AIRCRAFT (demographic data
from 1970 census updated for 1976 population)

SALT LAKE
KC135
70DNL

DEMOGRAPHIC PROFILE REPORT

PAGE 1

DEGREES
LATITUDE 40.8500
LONGITUDE 111.9810
23 POINT POLYGON
WEIGHTING PCT 100%

	LATEST	CHANGE FROM 70
1976 POPULATION	3	1
1976 HOUSEHOLDS	1	0
1975 PER CAP INCOME	\$ 2497	\$ 164
ANNUAL COMPOUND GROWTH	7.0%	

1970 CENSUS DATA

POPULATION			AGE AND SEX					
TOTAL	2	100.0%		MALE		FEMALE		TOTAL
WHITE	2	100.0%	0-5	0	0. %	0	0. %	0. %
NEGRO	0	0. %	6-13	0	0. %	0	0. %	0. %
OTHER	0	0. %	14-17	0	0. %	0	0. %	0. %
			18-20	0	0. %	0	0. %	0. %
SPAN	0	0. %	21-29	0	0. %	0	0. %	0. %
			30-39	0	0. %	0	0. %	0. %
			40-49	0	0. %	0	0. %	0. %
FAMILY INCOME (000)			50-64	0	0. %	0	0. %	0. %
\$0-5	0	0. %	65 +	0	0. %	0	0. %	0. %
\$5-7	0	0. %	TOTAL	0		0		
\$7-10	0	0. %	MEDIAN(AGE)	0.		0.		0.
\$10-15	0	0. %						
\$15-25	0	0. %	HOME VALUE (000)			OCCUPATION		
\$25-50	0	0. %	\$0-10	0	0. %	MGR/PROF	0	0. %
\$50 +	0	0. %	\$10-15	0	0. %	SALES	0	0. %
TOTAL	0		\$15-20	0	0. %	CLERICAL	0	0. %
			\$20-25	0	0. %	CRAFT	0	0. %
AVERAGE \$	0		\$25-35	0	0. %	OPERATVS	0	0. %
MEDIAN \$	0		\$35-50	0	0. %	LABORER	0	0. %
			\$50 +	0	0. %	FARM	0	0. %
			TOTAL	0		SERVICE	0	0. %
RENT						PRIVATE	0	0. %
\$0-100	0	0. %	AVERAGE \$	0				
\$100-150	0	0. %	MEDIAN \$	0				
\$150-200	0	0. %	% OWNER	0.		EDUCATION	ADULTS > 25	
\$200-250	0	0. %				0-8	0	0. %
\$250 +	0	0. %				9-11	0	0. %
TOTAL	0		AUTOMOBILES			12	0	0. %
			NONE	0	0. %	13-15	0	0. %
AVERAGE \$	0		ONE	0	0. %	16 +	0	0. %
MEDIAN \$	0		TWO	0	0. %			
% RENTER	0.		THREE+	0	0. %			
						HOUSEHOLD PARAMETERS		
UNITS IN STRUCTURE			HOUSEHOLDS WITH:			FAM POP	2	100.0%
1	0	0. %	TV	1	100.0%	INDIVIDUS	0	0. %
2	0	0. %	WASHER	0	0. %	GRP QTRS	0	0. %
3-4	0	0. %	DRYER	0	0. %	TOT POP	2	
5-9	0	0. %	DISHWASH	0	0. %			
10-49	0	0. %	AIRCOND	0	0. %	NO OF HH'S	1	
50 +	0	0. %	FREEZER	0	0. %	NO OF FAM'S	1	
MOBILE	0	0. %	2 HOMES	0	0. %	AVG HH SIZE	2.0	
						AVG FAM SIZE	2.0	

CACI, INC

TABLE 2. DEMOGRAPHIC DATA FOR SALT LAKE CITY INTERNATIONAL AIRPORT
70 DNL CONTOUR WITH KC-135 AIRCRAFT (demographic data
from 1970 census updated for 1976 population)

SALT LAKE
BASIC
65DNL

DEMOGRAPHIC PROFILE REPORT

PAGE 1

DEGREES
LATITUDE 40.8500
LONGITUDE 111.9810
41 POINT POLYGON
WEIGHTING PCT 100%

```

*****
*                                     *
*                               LATEST  CHANGE *
*                               FROM  70 *
* 1976 POPULATION                190    55 *
* 1976 HOUSEHOLDS                 67    25 *
* 1975 PER CAP INCOME $ 2679    $ 711 *
*                                     *
* ANNUAL COMPOUND GROWTH          5.9% *
*****

```

1970 CENSUS DATA

POPULATION		AGE AND SEX			
			MALE	FEMALE	TOTAL
TOTAL	135 100.0%				
WHITE	120 88.9%	0-5	9 12.2%	7 11.9%	11.9%
NEGRO	0 0.0%	6-13	16 21.6%	11 18.6%	20.0%
OTHER	15 11.1%	14-17	7 9.5%	3 5.1%	7.4%
		18-20	3 4.1%	4 6.8%	5.2%
SPAN	0 0.0%	21-29	6 8.1%	6 10.2%	8.9%
		30-39	9 12.2%	9 15.3%	13.3%
		40-49	6 8.1%	5 8.5%	8.1%
FAMILY INCOME (000)		50-64	12 16.2%	12 20.3%	17.8%
\$0-5	7 20.6%	65 +	6 8.1%	2 3.4%	5.9%
\$5-7	8 23.5%	TOTAL	74	59	
\$7-10	6 17.6%	MEDIAN(AGE)	24.0	27.0	25.5
\$10-15	12 35.3%				
\$15-25	1 2.9%	HOME VALUE (000)		OCCUPATION	
\$25-50	0 0.0%	\$0-10	7 28.0%	MGR/PROF	7 18.9%
\$50 +	0 0.0%	\$10-15	9 36.0%	SALES	0 0.0%
TOTAL	34	\$15-20	4 16.0%	CLERICAL	6 16.2%
		\$20-25	4 16.0%	CRAFT	6 16.2%
AVERAGE \$ 8156		\$25-35	0 0.0%	OPERATVS	9 24.3%
MEDIAN \$ 8000		\$35-50	0 0.0%	LABORER	3 8.1%
		\$50 +	1 4.0%	FARM	0 0.0%
		TOTAL	25	SERVICE	5 13.5%
				PRIVATE	1 2.7%
RENT					
\$0-100	0 0.0%	AVERAGE	\$16332		
\$100-150	0 0.0%	MEDIAN	\$12778		
\$150-200	0 0.0%	% OWNER	100.0	EDUCATION ADULTS > 25	
\$200-250	0 0.0%			0-8	14 22.2%
\$250 +	0 0.0%			9-11	14 22.2%
TOTAL	0	AUTOMOBILES		12	18 28.6%
		NONE	4 10.0%	13-15	15 23.8%
AVERAGE \$ 0		ONE	15 37.5%	16 +	2 3.2%
MEDIAN \$ 0		TWO	11 27.5%		
% RENTER 0.		THREE+	10 25.0%		
				HOUSEHOLD PARAMETERS	
UNITS IN STRUCTURE		HOUSEHOLDS WITH:		FAM POP	130 96.3%
1	31 83.8%	TV	42 100.0%	INDIVIDTS	5 3.7%
2	0 0.0%	WASHER	36 85.7%	GRP QTRS	0 0.0%
3-4	0 0.0%	DRYER	25 59.5%	TOT POP	135
5-9	0 0.0%	DISHWASH	7 16.7%	NO OF HH'S	42
10-49	0 0.0%	AIRCOND	12 28.6%	NO OF FAM'S	37
50 +	0 0.0%	FREEZER	13 31.0%	AVG HH SIZE	3.2
MOBILE	6 16.2%	2 HOMES	4 9.5%	AVG FAM SIZE	3.5

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TABLE 3. DEMOGRAPHIC DATA FOR SALT LAKE CITY INTERNATIONAL AIRPORT
65 DNL CONTOUR EXISTING OPERATIONS (demographic data
from 1970 census updated for 1976 population)

TABLE 4

COMPARISON OF POPULATION AND AREA FOR ALTERNATE
AIRCRAFT MIX AT SALT LAKE CITY INTERNATIONAL AIRPORT

	DNL 65	DNL 70
Population		
Existing	190	3
with KC-135	5789	3
Change	+5599	0
Acreage (Sq. Miles)		
Existing	13.4	6.1
with KC-135	18.2	8.5
Change	+ 4.8	+2.4



FIGURE 3. DNL NOISE CONTOURS SELFRIDGE AFB EXISTING OPERATIONS

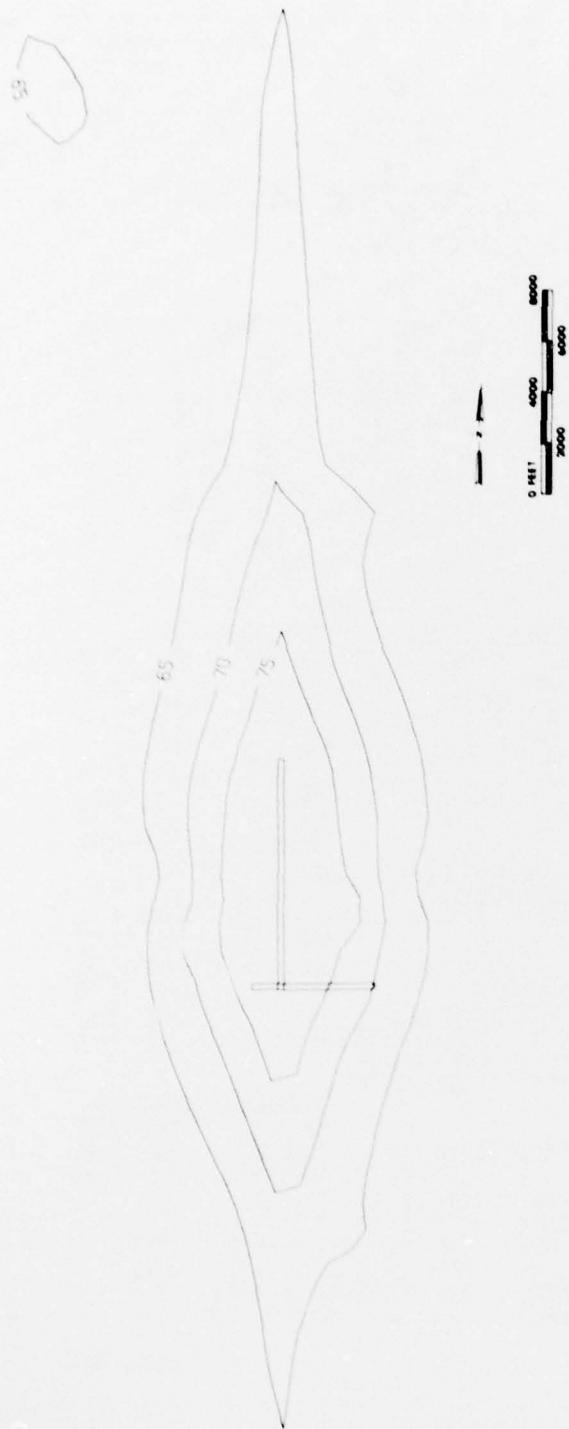


FIGURE 4. DNL NOISE CONTOURS SELFRIDGE AFB WITH MODIFIED OPERATIONS

SELFPRIDGE
OPT2
65DNL

DEMOGRAPHIC PROFILE REPORT

PAGE 1

DEGREES
LATITUDE 42.6120
LONGITUDE 82.8330
34 POINT POLYGON
WEIGHTING PCT 100%

```

*****
*                                     *
*               LATEST  CHANGE      *
*               FROM 70              *
* 1976 POPULATION 12097  2259      *
* 1976 HOUSEHOLDS  3754  1010      *
* 1975 PER CAP INCOME $ 4828 $ 1058 *
*                                     *
* ANNUAL COMPOUND GROWTH 3.5%      *
*****

```

1970 CENSUS DATA

POPULATION			AGE AND SEX			
TOTAL	9838	100.0%		MALE	FEMALE	TOTAL
WHITE	9258	94.1%	0-5	691 13.4%	658 14.1%	13.7%
NEGRO	544	5.5%	6-13	839 16.2%	837 18.0%	17.0%
OTHER	36	0.4%	14-17	346 6.7%	305 6.5%	6.6%
			18-20	281 5.4%	314 6.7%	6.0%
SPAN	124	1.3%	21-29	1114 21.5%	756 16.2%	19.0%
			30-39	662 12.8%	610 13.1%	12.9%
			40-49	545 10.5%	474 10.2%	10.4%
FAMILY INCOME (000)			50-64	489 9.5%	484 10.4%	9.9%
\$0-5	369	15.5%	65 +	206 4.0%	224 4.8%	4.4%
\$5-7	287	12.0%	TOTAL	5173	4662	
\$7-10	418	17.5%	MEDIAN(AGE)	24.5	23.6	24.1
\$10-15	688	28.8%				
\$15-25	525	22.0%	HOME VALUE (000)		OCCUPATION	
\$25-50	77	3.2%	\$0-10	72 6.2%	MGR/PROF	541 20.7%
\$50 +	24	1.0%	\$10-15	174 15.1%	SALES	208 7.9%
TOTAL	2388		\$15-20	201 17.4%	CLERICAL	470 18.0%
			\$20-25	216 18.7%	CRAFT	493 18.8%
AVERAGE	\$12042		\$25-35	291 25.2%	OPERATIVE	477 18.2%
MEDIAN	\$10872		\$35-50	143 12.4%	LABORER	105 4.0%
			\$50 +	57 4.9%	FARM	9 0.3%
			TOTAL	1154	SERVICE	301 11.5%
RENT					PRIVATE	13 0.5%
\$0-100	590	65.1%	AVERAGE	\$25429		
\$100-150	214	23.6%	MEDIAN	\$23009		
\$150-200	74	8.2%	% OWNER	56.0	EDUCATION	ADULTS > 25
\$200-250	23	2.5%			0-8	890 19.8%
\$250 +	5	0.6%			9-11	985 21.9%
TOTAL	906		AUTOMOBILES		12	1960 43.5%
			NONE	93 3.4%	13-15	367 8.2%
AVERAGE	\$ 57		ONE	1576 57.5%	16 +	300 6.7%
MEDIAN	\$ 77		TWO	879 32.1%		
% RENTER	44.0		THREE+	191 7.0%		
					HOUSEHOLD PARAMETERS	
UNITS IN STRUCTURE			HOUSEHOLDS WITH:		FAM POP	8773 89.2%
1	1409	51.2%	TV	2569 93.6%	INDIVIDS	432 4.4%
2	111	4.0%	WASHER	2181 79.5%	GRP QTRS	633 6.4%
3-4	76	2.8%	DRYER	1758 64.1%	TOT POP	9838
5-9	58	2.1%	DISHWASH	536 19.5%	NO OF HH'S	2744
10-49	443	16.1%	AIRCOND	288 10.5%	NO OF FAM'S	2393
50 +	17	0.6%	FREEZER	479 17.5%	AVG HH SIZE	3.4
MOBILE	638	23.2%	2 HOMES	23 0.8%	AVG FAM SIZE	3.7

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TABLE 5. DEMOGRAPHIC DATA FOR SELFPRIDGE AFB
65 DNL CONTOUR WITH MODIFIED OPERATIONS
(demographic data from 1970 census updated
for 1976 population)

SELEFRIDGE
OPT2
70DNL

DEMOGRAPHIC PROFILE REPORT

PAGE 1

DEGREES
LATITUDE 42.6120
LONGITUDE 82.8330

72 POINT POLYGON

WEIGHTING PCT 100%

	LATEST	CHANGE
		FROM 70
* 1976 POPULATION	6334	1343
* 1976 HOUSEHOLDS	1976	584
* 1975 PER CAP INCOME	\$ 4613	\$ 1024

	ANNUAL COMPOUND GROWTH	4.1%

1970 CENSUS DATA

POPULATION			AGE AND SEX					
TOTAL	4991	100.0%	MALE			FEMALE		
WHITE	4726	94.7%	0-5	356	13.6%	338	14.3%	13.9%
NEGRO	247	4.9%	6-13	421	16.1%	425	18.0%	17.0%
OTHER	18	0.4%	14-17	178	6.8%	147	6.2%	6.5%
SPAN	62	1.2%	18-20	151	5.8%	169	7.1%	6.4%
			21-29	565	21.5%	386	16.3%	19.1%
			30-39	326	12.4%	307	13.0%	12.7%
			40-49	273	10.4%	241	10.2%	10.3%
FAMILY INCOME (000)			50-64	248	9.5%	243	10.3%	9.8%
\$0-5	191	15.7%	65 +	105	4.0%	111	4.7%	4.3%
\$5-7	146	12.0%	TOTAL	2623		2367		
\$7-10	210	17.3%	MEDIAN(AGE)	24.3		23.4		23.9
\$10-15	366	30.1%	HOME VALUE (000)			OCCUPATION		
\$15-25	268	22.0%	\$0-10	37	6.5%	MGR/PROF	251	19.0%
\$25-50	27	2.2%	\$10-15	89	15.6%	SALES	95	7.2%
\$50 +	9	0.7%	\$15-20	106	18.6%	CLERICAL	235	17.8%
TOTAL	1217		\$20-25	116	20.4%	CRAFT	267	20.2%
AVERAGE	\$11587		\$25-35	149	26.2%	OPERATVS	253	19.1%
MEDIAN	\$10833		\$35-50	50	8.8%	LABORER	60	4.5%
RENT			\$50 +	22	3.9%	FARM	6	0.5%
			TOTAL	569		SERVICE	152	11.5%
						PRIVATE	4	0.3%
\$0-100	291	65.7%	AVERAGE	\$24249		EDUCATION ADULTS > 25		
\$100-150	125	28.2%	MEDIAN	\$22241		0-8	451	19.9%
\$150-200	23	5.2%	% OWNER	56.2		9-11	505	22.3%
\$200-250	4	0.9%	AUTOMOBILES			12	992	43.9%
\$250 +	0	0. %				13-15	173	7.7%
TOTAL	443					16 +	140	6.2%
AVERAGE	\$ 52					HOUSEHOLD PARAMETERS		
MEDIAN	\$ 76		NONE	36	2.6%	FAM POP	4461	89.4%
% RENTIER	43.8		ONE	821	59.3%	INDIVIDIS	212	4.2%
UNITS IN STRUCTURE			TWO	436	31.5%	GRP QTRS	318	6.4%
			THREE+	92	6.6%	TOT POP	4991	
			HOUSEHOLDS WITH:			NO OF HH'S	1392	
			TV	1304	93.7%	NO OF FAM'S	1223	
1	714	51.2%	WASHER	1124	80.7%	AVG HH SIZE	3.4	
2	61	4.4%	DRYER	911	65.4%	AVG FAM SIZE	3.6	
3-4	39	2.8%	DISHWASH	236	17.0%			
5-9	36	2.6%	AIRCND	182	13.1%			
10-49	199	14.3%	FREEZER	258	18.9%			
50 +	2	0.1%	2 HOMES	0	0. %			
MOBILE	343	24.6%						

CACI, INC

TABLE 6. DEMOGRAPHIC DATA FOR SELEFRIDGE AFB
70 DNL CONTOUR WITH MODIFIED OPERATIONS
(demographic data from 1970 census updated
for 1976 population)

DEMOGRAPHIC PROFILE REPORT

PAGE 1

SELFRIDGE
OPT2
75DNL

DEGREES
LATITUDE 42.6120
LONGITUDE 82.8330

47 POINT POLYGON

WEIGHTING PCT 100%

```

*****
*                                     *
*                               LATEST  CHANGE *
*                               FROM 70 *
* 1976 POPULATION                9      1 *
* 1976 HOUSEHOLDS                2      0 *
* 1975 PER CAP INCOME $ 5221    $ 1961 *
*                                     *
* ANNUAL COMPOUND GROWTH 2.0% *
*                                     *
*****
    
```

1970 CENSUS DATA

POPULATION							
TOTAL	8	100.0%		MALE		FEMALE	TOTAL
WHITE	7	87.5%	0-5	1	20.0%	1	25.0%
NEGRO	1	12.5%	6-13	1	20.0%	1	25.0%
OTHER	0	0.0%	14-17	0	0.0%	0	0.0%
			18-20	0	0.0%	0	0.0%
SPAN	0	0.0%	21-29	2	40.0%	1	25.0%
			30-39	1	20.0%	1	25.0%
			40-49	0	0.0%	0	0.0%
FAMILY INCOME (000)			50-64	0	0.0%	0	0.0%
\$0-5	0	0.0%	65 +	0	0.0%	0	0.0%
\$5-7	0	0.0%	TOTAL	5		4	
\$7-10	0	0.0%	MEDIAN(AGE)	14.0		14.0	14.0
\$10-15	0	0.0%					
\$15-25	0	0.0%	HOME VALUE (000)				
\$25-50	0	0.0%	\$0-10	0	0.0%	MGR/PROF	0 0.0%
\$50 +	0	0.0%	\$10-15	0	0.0%	SALES	0 0.0%
TOTAL	0		\$15-20	0	0.0%	CLERICAL	0 0.0%
			\$20-25	0	0.0%	CRAFT	0 0.0%
AVERAGE \$	0		\$25-35	0	0.0%	OPERATVS	0 0.0%
MEDIAN \$	0		\$35-50	0	0.0%	LABORER	0 0.0%
			\$50 +	0	0.0%	FARM	0 0.0%
			TOTAL	0		SERVICE	0 0.0%
RENT						PRIVATE	0 0.0%
\$0-100	1	100.0%	AVERAGE \$	0			
\$100-150	0	0.0%	MEDIAN \$	0			
\$150-200	0	0.0%	% OWNER	0.		EDUCATION ADULTS > 25	
\$200-250	0	0.0%				0-8	0 0.0%
\$250 +	0	0.0%				9-11	0 0.0%
TOTAL	1		AUTOMOBILES			12	2 100.0%
			NONE	0	0.0%	13-15	0 0.0%
AVERAGE \$	32		ONE	1	100.0%	16 +	0 0.0%
MEDIAN \$	100		TWO	0	0.0%		
% RENTER	100.0		THREE+	0	0.0%		
						HOUSEHOLD PARAMETERS	
UNITS IN STRUCTURE			HOUSEHOLDS WITH:			FAM POP	6 75.0%
1	0	0.0%	TV	2	100.0%	INDIVIDS	0 0.0%
2	0	0.0%	WASHER	1	50.0%	GRP QTRS	2 25.0%
3-4	0	0.0%	DRYER	1	50.0%	TOT POP	8
5-9	0	0.0%	DISHWASH	0	0.0%	NO OF HH'S	2
10-49	1	100.0%	AIRCOND	0	0.0%	NO OF FAM'S	2
50 +	0	0.0%	FREEZER	0	0.0%	AVG HH SIZE	3.0
MOBILE	0	0.0%	2 HOMES	0	0.0%	AVG FAM SIZE	3.0

CACI, INC

TABLE 7. DEMOGRAPHIC DATA FOR SELFRIDGE APB
75 DNL CONTOUR WITH MODIFIED OPERATIONS
(demographic data from 1970 census updated
for 1976 population)

DEMOGRAPHIC PROFILE REPORT

PAGE 1

SELFRIDGE
BASIC
65DNL

DEGREES
LATITUDE 42.6120
LONGITUDE 82.8330

83 POINT POLYGON

WEIGHTING PCT 100%

```

*****
*                               LATEST  CHANGE *
*                               FROM 70 *
* 1976 POPULATION           6334    1343 *
* 1976 HOUSEHOLDS           1976    584 *
* 1975 PER CAP INCOME $ 4613    $ 1024 *
*                               *
* ANNUAL COMPOUND GROWTH 4.1% *
*****

```

1970 CENSUS DATA

POPULATION			AGE AND SEX		
TOTAL	4991	100.0%	MALE FEMALE TOTAL		
WHITE	4726	94.7%	0-5	356 13.6%	338 14.3% 13.9%
NEGRO	247	4.9%	6-13	421 16.1%	425 18.0% 17.0%
OTHER	18	0.4%	14-17	178 6.8%	147 6.2% 6.5%
			18-20	151 5.8%	169 7.1% 6.4%
SPAN	62	1.2%	21-29	565 21.5%	386 16.3% 19.1%
			30-39	326 12.4%	307 13.0% 12.7%
			40-49	273 10.4%	241 10.2% 10.3%
FAMILY INCOME (000)			50-64	248 9.5%	243 10.3% 9.8%
\$0-5	191	15.7%	65 +	105 4.0%	111 4.7% 4.3%
\$5-7	146	12.0%	TOTAL	2623	2367
\$7-10	210	17.3%	MEDIAN(AGE)	24.3	23.4 23.9
\$10-15	366	30.1%			
\$15-25	268	22.0%	HOME VALUE (000)		OCCUPATION
\$25-50	27	2.2%	\$0-10	37 6.5%	MGR/PROF 251 19.0%
\$50 +	9	0.7%	\$10-15	89 15.6%	SALES 95 7.2%
TOTAL	1217		\$15-20	106 18.6%	CLERICAL 235 17.8%
			\$20-25	116 20.4%	CRAFT 267 20.2%
AVERAGE	\$11587		\$25-35	149 26.2%	OPERATIVES 253 19.1%
MEDIAN	\$10833		\$35-50	50 8.8%	LABORER 60 4.5%
			\$50 +	22 3.9%	FARM 6 0.5%
			TOTAL	569	SERVICE 152 11.5%
					PRIVATE 4 0.3%
RENT			EDUCATION ADULTS > 25		
\$0-100	291	65.7%	AVERAGE	\$24249	0-8 451 19.9%
\$100-150	125	28.2%	MEDIAN	\$22241	9-11 505 22.3%
\$150-200	23	5.2%	% OWNER	56.2	12 992 43.9%
\$200-250	4	0.9%			13-15 173 7.7%
\$250 +	0	0. %			16 + 140 6.2%
TOTAL	443		AUTOMOBILES		
			NONE	36 2.6%	
AVERAGE	\$ 52		ONE	821 59.3%	
MEDIAN	\$ 76		TWO	436 31.5%	
% RENTER	43.8		THREE+	92 6.6%	
UNITS IN STRUCTURE			HOUSEHOLDS WITH:		
1	714	51.2%	TV	1304 93.7%	HOUSEHOLD PARAMETERS
2	61	4.4%	WASHER	1124 80.7%	FAM POP 4461 89.4%
3-4	39	2.8%	DRYER	911 65.4%	INDIVIDS 212 4.2%
5-9	36	2.6%	DISHWSH	236 17.0%	GRP QTRS 318 6.4%
10-49	199	14.3%	AIRCOND	182 13.1%	TOT POP 4991
50 +	2	0.1%	FREEZER	258 18.5%	
MOBILE	343	24.6%	2 HOMES	0 0. %	NO OF HH'S 1392
					NO OF FAM'S 1223
					AVG HH SIZE 3.4
					AVG FAM SIZE 3.6

CACI, INC

TABLE 8. DEMOGRAPHIC DATA FOR SELFRIDGE AFB
65 DNL CONTOUR WITH EXISTING OPERATIONS
(demographic data from 1970 census updated
for 1976 population)

SELFRIDGE
BASIC
70DNL

DEMOGRAPHIC PROFILE REPORT

PAGE 1

DEGREES
LATITUDE 42.6120
LONGITUDE 82.8330

51 POINT POLYGON

WEIGHTING FCT 100%

```

*****
*                                     *
*               LATEST   CHANGE   *
*               FROM 70 *
* 1976 POPULATION   1769   138   *
* 1976 HOUSEHOLDS   389    50   *
* 1975 PER CAP INCOME $ 5342 $ 2127 *
*                                     *
* ANNUAL COMPOUND GROWTH 1.4%   *
*****
  
```

1970 CENSUS DATA

POPULATION			AGE AND SEX			
TOTAL	1631	100.0%		MALE	FEMALE	TOTAL
WHITE	1391	85.3%	0-5	147 15.3%	130 19.3%	17.0%
NEGRO	226	13.9%	6-13	149 15.5%	148 22.0%	18.2%
OTHER	14	0.9%	14-17	34 3.5%	32 4.8%	4.0%
			18-20	77 8.0%	52 7.7%	7.9%
SPAN	62	3.8%	21-29	339 35.3%	156 23.2%	30.3%
			30-39	157 16.4%	112 16.7%	16.5%
			40-49	49 5.1%	29 4.3%	4.8%
FAMILY INCOME (000)			50-64	7 0.7%	8 1.2%	0.9%
\$0-5	97	28.6%	65 +	0 0.0%	5 0.7%	0.3%
\$5-7	90	26.5%	TOTAL	959 0.0%	672	
\$7-10	71	20.9%	MEDIAN(AGE)	23.9	19.5	21.8
\$10-15	44	13.0%				
\$15-25	32	9.4%	HOME VALUE (000)		OCCUPATION	
\$25-50	2	0.6%	\$0-10	0 0.0%	MGR/PROF	15 16.3%
\$50 +	3	0.9%	\$10-15	0 0.0%	SALES	17 18.5%
TOTAL	339		\$15-20	0 0.0%	CLERICAL	33 35.9%
			\$20-25	0 0.0%	CRAFT	0 0.0%
AVERAGE \$ 8224			\$25-35	0 0.0%	OPERATIVE	8 8.7%
MEDIAN \$ 6600			\$35-50	0 0.0%	LABORER	3 3.3%
			\$50 +	0 0.0%	FAHM	0 0.0%
			TOTAL		SERVICE	16 17.4%
					PRIVATE	0 0.0%
RENT						
\$0-100	246	84.5%	AVERAGE \$	0		
\$100-150	40	13.7%	MEDIAN \$	0		
\$150-200	5	1.7%	% OWNER	0.	EDUCATION ADULTS > 25	
\$200-250	0	0.0%			0-8	36 6.5%
\$250 +	0	0.0%			9-11	94 17.1%
TOTAL	291		AUTOMOBILES		12	302 54.8%
			NONE	0 0.0%	13-15	57 10.3%
AVERAGE \$ 22			ONE	266 78.2%	16 +	62 11.3%
MEDIAN \$ 59			TWO	65 19.1%		
% RENTER 100.0			THREE+	9 2.6%	HOUSEHOLD PARAMETERS	
					FAM POP	1315 80.6%
UNITS IN STRUCTURE			HOUSEHOLDS WITH:		INDIVIDS	0 0.0%
1	46	13.5%	TV	324 95.6%	GRP QTRS	316 19.4%
2	30	8.8%	WASHER	298 87.9%	TOT POP	1631
3-4	21	6.2%	DRYER	289 85.3%		
5-9	12	3.5%	DISHWASH	75 22.1%	NO OF HH'S	339
10-49	189	55.6%	AIRCND	0 0.0%	NO OF FAM'S	339
50 +	0	0.0%	FREEZER	49 14.5%	AVG HH SIZE	3.9
MOBILE	42	12.4%	2 HOMES	0 0.0%	AVG FAM SIZE	3.9

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TABLE 9. DEMOGRAPHIC DATA FOR SELFRIDGE APB
70 DNL CONTOUR WITH EXISTING OPERATIONS
(demographic data from 1970 census updated
for 1976 population)

TABLE 10

COMPARISON OF POPULATION AND AREA FOR ALTERNATE
AIRCRAFT MIX AT SELFRIDGE AFB

	DNL 65	DNL 70	DNL 75
Population			
Existing	6334	1769	9
Modified Operations	12097	6334	9
Change	+ 5763	+ 4565	0
Acreage (Sq. Miles)			
Existing	5.9	2.9	1.5
Modified Operations	11.5	5.0	2.2
Change	+ 5.6	+ 2.1	+ .7

by NOISEMAP. If demographic information is needed - either on a regular, frequently-occurring basis, or as an option for less frequent use, but where rapid response is needed - then the following development steps are recommended.

1. The USAF should obtain SITE II or a comparable program if available. This will provide the basic capability of obtaining demographic data.
2. Modification to the existing GPCP package should be obtained so that the X-Y coordinates of the contours can be obtained.
3. The NOISEMAP process should be modified so that the demographic data can be output automatically. The routine written for this study could be used as the basis for this modification.

If, in addition to the collection of basic demographic data (as covered in this report), further calculations are desired which utilize the demographic data (for example, in the calculation of the Fractional Impact Index) further calculation and programming steps are needed. These calculation procedures should be quite straightforward to develop since the needed noise contour and demographic information will be at hand.

REFERENCES

1. Horonjeff, R. D., Kandakuri, R. R., Reddingius, N. H., Community Noise Exposure Resulting From Aircraft Operations: Computer Program Description, AMRL-TR-73-109 (ADA-004821). Aerospace Medical Research Laboratory, October 1974.
2. SITE II User's Manual, CACI, Inc., Arlington, Virginia, 1976.